Rhodora

JOURNAL OF THE

NEW ENGLAND BOTANICAL CLUB

Conducted and published for the Club, by

REED CLARK ROLLINS, Editor-in-Chief

ALBERT FREDERICK HILL
STUART KIMBALL HARRIS
RALPH CARLETON BEAN
CARROLL EMORY WOOD, JR.
IVAN MACKENZIE LAMB
} Associate Editors

Vol. 62 March, 1960 No. 735

CONTENTS:

The New England Botanical Club, Inc.

Botanical Museum, Oxford St., Cambridge 38, Mass.

RHODORA.—A monthly journal of botany, devoted primarily to the flora of North America and floristically related areas. Price, $6.00 per year, net, postpaid, in funds payable at par in United States currency in Boston; single copies (if available) 60 cents. Back volumes 1-58, with a few incomplete, can be supplied at $5.00 per volume. Volume 59— available at $6.00. Somewhat reduced rates for complete sets can be obtained upon application.

Scientific papers and notes, relating directly or indirectly to the plants of North America, will be considered by the editorial committee for publication. Articles concerned with systematic botany and cytotaxonomy in their broader implications are equally acceptable. All manuscripts should be double-spaced throughout. Please conform to the style of recent issues of the journal. Illustrations can be used only if the cost of engraver's blocks is met through the author or his institution. Forms may be closed five weeks in advance of publication. Extracted reprints, if ordered in advance, will be furnished at cost.

Address manuscripts and proofs to Reed C. Rollins,
Gray Herbarium, 22 Divinity Avenue, Cambridge 38, Mass.

Subscriptions and orders for back issues (making all remittances payable to RHODORA) should be sent to Albert F. Hill, Botanical Museum, Oxford Street, Cambridge 38, Mass.

Second Class Postage Paid at Boston, Mass.

Printed by
THE LEXINGTON PRESS, INC.
Lexington, Mass.

Rhodora

JOURNAL OF THE

NEW ENGLAND BOTANICAL CLUB

Vol. 62 March, 1960 No. 735

REVISION OF HETEROTHECA, SECTION HETEROTHECA (COMPOSITAE)[1]

BURDETTE L. WAGENKNECHT

Heterotheca until recently has been considered to be a small genus of the tribe Astereae and has not been treated systematically since De Candolle's revision for the Prodromus (1836). Shinners (1951) merged *Chrysopsis* with *Heterotheca*, resulting in a considerably enlarged genus. Acceptance of this merger requires that the species constituting *Heterotheca sensu stricto* should be placed in *Heterotheca*, section *Heterothcca*, and the remaining species arranged in various sections similar to those in which they had been previously placed in *Chrysopsis*.

Heterotheca section *Heterotheca* is native to continental North America and is an occupant of sandy or disturbed habitats. It ranges from Long Island south to Georgia and Florida on the coastal plain, west to California and from Illinois southwest to the state of Oaxaca, Mexico. It has been introduced in Brazil and Hawaii and one species is rarely cultivated in Europe.

The present treatment is based upon the examination of

---

[1]Part of a dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the University of Kansas. I should like to take this opportunity to express my appreciation to Prof. R. L. McGregor for his advice and assistance while directing this study. The critical examination of the manuscript by Dr. L. H. Shinners of Southern Methodist University has been helpful. A grant from the Society of the Sigma Xi made possible much of the field work undertaken in connection with this study.

more than 1500 specimens from fifteen[2] herbaria, and a study of three species and their varieties in the field. Only a limited number of representative specimens are cited for most of the taxa involved. A complete list of all specimens examined in this study may be found in the original thesis at the Library of the University of Kansas.

Generic Relationships

The first species of *Heterotheca* was described as a species of *Inula*. *Heterotheca* can be separated from *Inula* and the tribe Inuleae by the flattened and smooth style-branches, extended into lanceolate hairy appendages and by the obtuse and barely notched anther bases. Bentham and Hooker (1876) placed the genus *Heterotheca* in the tribe Astereae. The most closely related genus is *Chrysopsis*, which shows great similarity in its morphology and its preference for sandy habitats. *Heterotheca* as a genus is of a more weedy nature. These two genera are usually maintained as separate entities because of the absence of a pappus from the ray achenes in *Heterotheca* and the presence of a well-developed double pappus on the ray achenes in *Chrysopsis*.

At least two authors have felt that the two genera should not be separated. Baillon (1886) not only merged *Chrysopsis* and *Heterotheca* with *Hysterionica* but also included *Grindelia, Pentachaeta, Aphantochaeta, Bradburia, Haplopappus, Xanthisma, Chrysothamnus* and *Lessingia* under the same genus. The above listed genera were to be considered as sections of *Hysterionica*. No transfers of species were made. The elongated lanceolate stylar appendage can be used to separate *Heterotheca* and *Chrysopsis* from *Hysterionica*, which has a short deltoid stylar appendage.

Shinners (1951) questioned only the segregation of *Heterotheca* and *Chrysopsis* and pointed out that it seemed unreasonable to preserve all the diverse sections of *Chrysopsis* within the same genus and to exclude *Heterotheca*,

[2]The abbreviations employed in referring to these herbaria are those of Lanjouw and Stafleu (1952) and are as follows: CU, Cornell University; F, Chicago Natural History Museum; GH, Gray Herbarium; KANU, University of Kansas; MEXU, Universidad Nacional de Mexico; MO, Missouri Botanical Garden; NEB, University of Nebraska; NY, New York Botanical Garden; OKLA, Oklahoma State University; P, Museum National d'Histoire Naturelle; PH, Academy of Natural Sciences of Philadelphia; SMU Southern Methodist University; TEX, University of Texas; UC, University of California; and US, United States National Herbarium.

which resembles closely certain sections of *Chrysopsis*. In particular he thought it inconsistent to segregate *Heterotheca* based on the absence of the pappus from the ray achenes and to maintain the section *Ammodia*, as a part of *Chrysopsis*, even though the entire ray cycle of the head was missing.

One line of investigation which offered the best interpretation of this situation was a study of the pappus characters of all specimens studied. In all manuals treating the genus, there are references to the presence of at least a rudimentary pappus on the ray achenes. De Candolle considered *Heterotheca chrysopsidis* to be sectionally distinct from the remainder of the genus because of the presence of a pappus on the ray achenes. His use of the epithet *chrysopsidis* is a reflection on his observation of an intermediate character between *Heterotheca* and *Chrysopsis*. Examination of the isotypes of this species reveals that the pappus characters indicated by De Candolle were not consistent in all specimens within the type collection.

Studies of all collections throughout the genus revealed that approximately three per cent of the specimens examined bore a rudimentary pappus. One specimen, *F. B. Jones 430*, from San Patricio Co., Texas (OKLA), is of great interest. The ray achenes produced by this plant bear a double pappus indistinguishable from that of the disk achenes. In addition to the presence of a pappus, the ray achenes further resemble the disk achenes in that they are densely sericeus. Another specimen (SMU), bearing an identical label and of identical appearance, has glabrous, epappose ray achenes. Any attempt to identify these two plants with current keys other than those of Shinners (1958) would result in the placing of these two specimens in different genera. The discovery of such wide variability of the pappus within *Heterotheca*, including that characteristic of *Chrysopsis*, leads me to support Shinners' conclusion that the two genera should be merged.

One other genus shows some relationship with the group studied. *Croptilon (Isopappus;* often included in *Haplopappus)* can be distinguished from *Heterotheca* by the single pappus found on the disk achenes. Those specimens of *Heterotheca grandiflora* in which disk achenes lack an outer

pappus show a trend in this direction. However, the merging of *Croptilon* with *Heterotheca* could not be recommended without a great deal of further study.

Chromosome numbers have not provided any evidence for or against the merger of these genera. Darlington's lists (1956) show n=9 to be the most common number in the tribe Astereae. This was the number found in *Heterotheca grandiflora* by Heiser (1948). Dr. R. C. Jackson, Department of Botany, University of Kansas, and I found n=9 in *H. latifolia* var *macgregoris*. (Voucher specimen *Wagenknecht 4640*, 1 mi. s. Coldwater, Comanche Co., Kansas, on file at the Herbarium of the University of Kansas (KANU)). Dr. B. L. Turner, University of Texas, informs me in private correspondence that he has unpublished counts n=9 in *Chrysopis graminifolia* and *Heterotheca inuloides*. Dr. R. C. Jackson (1959) has a count of n=18 in *Chrysopsis foliosa* Nutt. Dr. Turner (1959) has reported n=5 in *Chrysopsis pilosa* and more recently, he sent me a manuscript by Mr. M. O. Cherry, Biology Department, Pasadena High School, Pasadena, Texas, correcting this latter number to n=4.

Taxonomic Treatment

Heterotheca Cassini, Bull. Soc. Philom. 137. 1817

Calycium Ell., Sketch **2**: 338. 1824.

Diplocoma D. Don in Sweet, Brit. Fl. Gard. **3**: 246. 1828.

Stelmanis Raf., Fl. Tellur. **2**: 47. 1836.

Heterotheca section *Chaetactis* DC., Prod. **5**: 317. 1836.

Heterotheca section *Gymnactis* DC., Prod. **5**: 317. 1836.

Hysterionica section *Heterotheca* Baillon, Histoire des Plantes **8**: 155. 1886.

Annual, biennial, or perennial, simple, or branched aromatic herbs. Stem strict, ascending, or decumbent, striate, pilose, sericeous, scabrous or glandular-hairy. Leaves alternate, simple, entire, dentate to serrate, ovate to lanceolate, to elliptical, scabrous to hirsute above, scabrous to pilose below. Basal and lower cauline leaves petiolate, the petioles often with auriculate-clasping bases; upper cauline leaves sessile. Inflorescence paniculate to corymbose, the heads on short lateral branches, smaller than those terminating main branches. Heads hemispheric to broadly campanulate, the phyllaries in 4-6 series, glabrous, glandular-hairy, scabrous or sericeous, the inner series with scarious edges, the tips pilose. Ray flowers numerous, pistillate, often abortive, spreading, characteristically rolling into a tight coil when dried, narrowly ligulate, or linear, each terminated by three teeth, tubular at the base,

the tube pubescent, producing a slender glabrous style, and a narrow, glabrous, bifid stigma, the achene trigonous, glabrous to slightly sericeous, the pappus absent or present as a toothed crown or as a few caducous bristles. Disk flowers numerous, perfect, tubular, slender at the base and widening upwards, five-toothed, five-nerved, the nerves alternate with the ovate-lanceolate, acute, spreading teeth. Stamens five, naked at the base with deltoid appendages at the apex, exserted from corolla at anthesis. Style glabrous, bifid, short, villous at the acute apex. Achene compressed, hispid to sericeous, crowned with a radiately spreading double pappus, the inner series of long, brown, slender, barbellate hairs, the outer series of short, flat, chaff-like appendages or of short, barbellate hairs, white or of the same color as the inner series. Receptacle flat, alveolate, the partitions between the achenes scarious, the points very unequal.

Native to the United States and Mexico, introduced in Hawaii and Brazil. TYPE SPECIES: *Heterotheca subaxillaris* (Lam.) Britton & Rusby.

In 1824, Elliott proposed a provisional genus *Calycium*, depending upon whether *Inula scabra Pursh* should be considered sufficiently distinct to warrant generic segregation. However, no transfer of the specific epithet was made.

KEY TO SPECIES AND VARITIES

1. Habit strict, — 1-2.5 m. tall (spring form 10-30 cm. tall); stem 0.9-1.7 cm. in diameter; cauline leaves petiolate below, sessile above, coarsely serrate to entire; inflorescence of short, paniculate axillary branches; peduncles and phyllaries densely capitate-glandular. ..... *H. grandiflora.*
1. Habit erect to procumbent, if strict; inflorescence corymbose; stems less than 0.9 cm. in diameter, or if larger, with cordate, clasping, cauline leaves; peduncles and phyllaries not densely capitate-glandular.
   2. Habit erect or of several strict stems from a central caudex; lateral branches not well developed; inflorescence corymbose; leaves lanceolate; peduncles elongate and devoid of leaves.
      3. Perennial, several strict stems arising from a central caudex; heads 1.5-3.0 cm. in diameter, broadly campanulate.
         4. Stem and leaves densely pilose to villous; phyllaries densely villous with large jointed hairs. .... *H. inuloides* var. *inuloides.*
         4. Stem and leaves pilose; phyllaries with sparse, slender hairs. ..... *H. inuloides* var. *rosei.*
      3. Annual, heads 0.5-1.2 cm. in diameter, narrowly campanulate. ..... *H. leptoglossa.*
   2. Habit erect to decumbent, the lateral branches well developed; leaves ovate, elliptical to lanceolate; inflorescence paniculate to paniculate-corymbose; peduncles remotely to densely foliar.
      5. Perennial from well-developed woody caudex; blades of basal and cauline leaves ovate to elliptical, serrate to rarely entire, petiolate, the petioles of basal leaves up to 4 cm. in length; pappus a deep reddish-brown. ..... *H. chrysopsidis.*

5. Annual or weakly perennial, the caudex not developed; leaves elliptical or lanceolate, serrate to entire, the petioles of basal leaves less than 3 cm. long; pappus tan to white.
   6. Habit erect to decumbent, up to 1 m. tall, the stem scabrous; lower leaf surface scabrous; phyllaries with well-defined tuft of short thick hairs on outer surface.
      7. Habit erect; basal leaves serrate, the lateral veins readily discernible. ..... *H. subaxillaris* var. *subaxillaris.*
      7. Habit procumbent; basal leaves entire or remotely serrate, the veins obscure. ..... *H. subaxillaris* var. *procumbens.*
   6. Habit erect, up to 2 m. in height; stem and lower leaf surfaces velutinous or pilose, the upper leaf surface scabrous to pilose; phyllaries sericeous and sparsely glandular.
      8. Stem up to 1.2 cm. in diameter, the lateral branches coarse; leaves cordate-clasping, sparsely pilose above; phyllaries densely glandular and pilose. ..... *H. psammophila.*
      8. Stem 4-9 mm. in diameter, the lateral branches slender, or if coarse, leaves long-pilose; phyllaries not densely glandular.
         9. Leaves scabrous above; heads less than 0.9 cm. in width. ..... *H. latifolia* var. *latifolia.*
         9. Leaves pilose or velutinous above; heads more than 0.9 cm. wide.
            10. Lateral branches slender; leaves oblong-lanceolate, the veins not prominently raised. ..... *H. latifolia* var. *macgregoris.*
            10. Lateral branches coarse; leaves elliptical to lanceolate, the veins prominently raised. ..... *H. latifolia* var. *arkansana.*

1. **H. grandiflora** Nutt., Trans. Am. Philos. Soc. Ser. 2, **7**: 315. 1841
Diplopappus scaber (Pursh) Hook., Fl. Bor. Am. **2**: 22. 1834. Not *Heterotheca scabra* (Nutt.) DC.; *Inula scabra* Nutt.; *Inula scabra* Pursh. *Heterotheca floribunda* Bentham in Hinds, Bot. Sulph. 24. 1844.

Annual or biennial, somewhat rosulate, aromatic herbs, 0.5-2.5 m. (spring form 10-30 cm.) tall, unbranched below or with serotinous, assurgent basal branches. Stem striate, coarse, up to 1.7 cm. in diameter at the base, glandular-hairy above, progressively more densely hirsute below with spreading hairs up to 6 mm. long. Leaves ovate to elliptical or oblong, serrate to entire, 5-8 cm. long, 2-3 cm. wide, pilose on both surfaces. Lower cauline leaves petiolate, the petioles 3-7 cm. long, expanded into auriculate-clasping bases. Cauline leaves progressively smaller upwards, 2-4 cm. long, 0.5-1.5 cm. wide, sessile, coarsely serrate, oblong-lanceolate. Inflorescence paniculate-axillary, the involucres at the tips of the terminal branches 9-14 mm. wide, 6-9 mm. high, those of the short lateral branches 9-14 mm. wide, 6-9 mm. high, the heads campanulate to hemispherical. Phyllaries in 4-6 series, the outer series 3-5 mm. long, the inner series 6-9 mm. long, densely

capitate-glandular on the outer surface, the margins scarious, the apex villous. Ray flowers 25-40, the corolla-tube 4-7 mm. long, the ligule 5-8 mm. long; disk flowers 30-75, the tube 4-6 mm. long. Ray achenes 2-5 mm. long, epappose, trigonous, glabrous or slightly sericeous on the angles. Disk achenes 4-6 mm. long, obovate, compressed, sericious. Pappus of two series, the inner series of numerous barbellate bristles, 6-9 mm. long, reddish brown to white, the outer series squamellate setaceous or of short barbellate bristles 0.4-0.7 mm. long, or absent. Receptacle flat, white, alveolate, the partitions irregularly terminated by unequal chartaceous teeth.

TIME OF FLOWERING: April to December.

TYPE AND TYPE LOCALITY: "Rocks, circa Santa Barbara." Nuttall. not seen.

DISTRIBUTION AND HABITATS: native in eastern Arizona, California, Sonora and Baja California, Mexico and introduced in Hawaii. Sandy or disturbed soils at altitudes from sea level to 2,000 feet.

The first reference to this species is that of Hooker (1834). He erroneously considered it to be *Inula scabra* Pursh and in his treatment of the species transferred it to the genus *Diplopappus* as *D. scaber*. The description of Pursh cites *Inula subaxillaris* Lam. as a synonym and is therefore illegitimate under Article 60 of the Rules of Nomenclature. Hooker's transfer of this illegitimate epithet is also illegitimate.

Heterotheca floribunda Bentham was collected in the vicinity of San Pedro and of San Quentin, California, areas in which *H. grandiflora* was at the time the sole representative of this genus. Bentham's description matches Nuttall's earlier description in all essential points and is here, as in most previous works covering this species, considered to be a synonym of *H. grandiflora* Nutt.

The weedy nature of the species is shown by the appearance on a great many labels of habitats described as disturbed ground, fields, lots and roadsides. The creation of these habitats through urbanization and agricultural practices has increased its range. An indication that it is extending the northern boundaries of its range can be shown by a study of the dates of earliest collections in various California counties. In general, the first collections in counties south of San Francisco bear dates at least twenty-five years earlier than those of counties north of San Francisco.

Degener (1934) states that this species was introduced into the Hawaiian Islands before 1920. St. John and Hosaka

(1932) reported *Heterotheca grandiflora* as a noxious weed of the pineapple fields of Hawaii.

Representative specimens. **Arizona:** Santa Rita Forest Reserve, *Griffiths 5977* (US). **California:** Alameda Co.: *Rose 49180* (NY). Butte Co.: 1 mi. above Pentz, *Heller 15840* (UC). Contra Costa Co.: Antioch, *E. Crum 1731* (UC). Fresno Co.: *Brandegee, July 20, 1905* (US). Los Angeles Co.: bank of Arroyo Seco, *Grinnell 377* (F); Catalina Island, *Nuttall 864* (F). Monterey Co.: 1 mi. northeast of Elkhorn, *Axelrod 616* (UC). Orange Co.: *Mason 2901* (UC). Placer Co.: Wheatland, *Heller 13833* (F, US). Riverside Co.: Riverside, *Barrus 22* (CU). San Benito Co.: *Balls 15890* (OKLA). San Bernardino Co.: San Bernardino Valley, *S. & W. Parrish 177* (F, GH, NY, P, PH, UC, US). San Mateo Co.: *Rose 34478* (OKLA). Santa Barbara Co.: near type area, Santa Barbara, *Eastwood 127* (F, GH, NY, UC, US). Santa Clara Co.: San Jose, *Davy 243* (UC). Santa Cruz Co.: 5 mi. S. Santa Cruz, *Wiegand 2416* (CU). Sonoma Co.: Northwood, *Hoffman* (UC). Stanislaus Co.: Oakdale, *Crum 1552* (UC). Tuolumne Co.: 1 mi. W. Confidence, *Belshaw 191* (UC). MEXICO: **Baja California:** 27 mi. N. Ensenada, *Wiggins and Gillespie 3969* (F, GH, MEXU, MO, NY, US). **Sonora:** *Fr. Thomas* (P).

2. **H. inuloides** Cass., Dict. Sci. Nat. 51: 460. 1827

Annual, biennial, or short lived perennial aromatic herbs, 50-150 cm. tall, unbranched below (second year's growth of several basal, assurgent branches arising from a central caudex), the stem striate, coarse, villous, green or various shades of purple. Leaves ovate to lanceolate, entire to serrate, 3-7 cm. long, 1-3 cm. wide, pilose on upper and lower surfaces. Lower cauline leaves petiolate, the petioles 2-8 cm. long, often with auriculate-clasping bases. Cauline leaves becoming progressively smaller above, 2-5 cm. long, 0.3-2 cm. wide, sessile, entire, lanceolate. Inflorescence corymbose. Involucres 1.5-3.0 cm. wide, 1.0-1.8 cm. high, hemispheric to broadly campanulate. Phyllaries in 4-6 series, the outer 2-4 mm. long, the inner 7-14 mm. long, densely villous to pilose on outer surface, the hairs prominently multicellular to unicellular, the tips purple, pilose, edges scarious. Ray flowers 25-40, the corolla tube 4-7 mm. long, the ligule 8-15 mm. long; disk flowers 40-60, the corolla tube 4-7 mm. long. Ray achenes 2-4 mm. long, trigonous, glabrous or with a few sericeous hairs. Disk achenes 2.5-5 mm. long, compressed, obovate, densely sericeous. Inner pappus of numerous barbellate bristles 4-9 mm. long, the outer squamellate-setaceous, or of short barbellate bristles 0.3-0.6 mm. long. Receptacle flat, white, alveolate, the partitions irregularly terminated by unequal chartaceous or occasionally fleshy points.

2a. **H. inuloides** var. **inuloides**

Diplocoma villosa D. Don, in Sweet, Brit. Fl. Gard. 3:246. 1828.

Doronicum mexicanum Cerv., in Link & Otto, Icones Pl. Rar. 43. 1828.

Leaves and stems densely pilose, the phyllaries densely villous with long jointed hairs.

TIME OF FLOWERING: April to December.

TYPE AND TYPE LOCALITY: Desfontaines, reported to be in the Herbarium Universitatis Florentinae, Florence, Italy. Cultivated in The Garden of the King. Grown from seeds thought to have come from DeCandolle, who thought they were of Mexican origin. Not seen.

DISTRIBUTION AND HABITATS: San Luis Potosi to southern Oaxaca, and from Orizaba to the western border of the state of Mexico. Sandy or sandy clay soils, open pine forests, fields, and roadsides, at altitudes of 4,000 to 10,000 feet.

Although Cassini (1827) was not sure of the country of origin or the manner in which the plant arrived at the Jardin du Roi, the description is quite precise. His description of the involucre and foliage permits no doubt that his plants belong to the variety *inuloides*.

Diplocoma villosa Don and *Doronicum mexicanum* Cerv. are not only well described but are also illustrated in detail. A comparison of these descriptions and illustrations with Cassini's description and with specimens of *Heterotheca inuloides* leaves no doubt that these are the same species.

This species has been used by the natives of central Mexico as a medicinal herb. The leaves and involucres are dried, packaged and sold in small shops under the common name "Arnica." The medicinal properties attributed to concoctions from this plant are similar to those attributed to the European Arnica and probably account for the common name. The illustration in Ramirez' (1898) account of the medicinal properties of the species appears to be of this variety, although there is no reason to expect that the following variety is not used for the same purpose.

Representative specimens. MEXICO: **Federal District:** Ajusco, *Lyonnet 434* (GH, NY). Rio Frio, *Wagenknecht 2783* (KANU); Temascaltepec, *Hinton 847* (NY, SMU, US). **Hidalgo:** Valley of Tula, *Pringle* (PH, UC, US). **Morelos:** Cuernavaca, *Kenoyer A 151* (F, GH). **Oaxaca:** Vincente Guerro, *Wagenknecht 2795* (KANU); Monte Alban, *Kenoyer 1524* (GH). **Puebla:** Esperanza, *Pittier 401* (US); Teziutlan, *Wagenknecht 2825* (KANU). **San Luis Potosi:** San Luis Potosi, *Parry & Palmer 372* (GH, NY, US). **Vera Cruz:** Orizaba, *Seaton 164* (F, GH, NY, MO, US).

2b. **H. inuloides** var. **rosei** var. nov.

A varietate *inuloides* differt caule et foliis plus minusve pilosis, foliis ciliatis, phyllariis villosis.

Leaves and stem sparsely pilose, leaf margins ciliate, phyllaries sparingly villous.

The varietal epithet honors J. N. Rose whose comments on variation in this species led to the discovery of this variety.

TIME OF FLOWERING: April to December.

TYPE: *B. L. Wagenknecht 2846*, sandy soil along roadsides, 30 miles east of Guadalajara, Jalisco, Mexico. July 25, 1956. (KANU).

DISTRIBUTION AND HABITATS: States of Aguascalientes, Colima, Jalisco, Michoacán, Nayarit, and Zacatecas. Sandy soil along roadsides, in fields and open pine forests at altitudes of 3,000 to 5,000 feet.

This entity has been the source of some previous discussion. Gray (1887) examined *Palmer 268* from Guadalajara, Jalisco, and referred it to *Heterotheca leptoglossa* DC., regarding it as only a form of *H. lamarckii* Cass. [H. subaxillaris]. J. N. Rose (1894) examined the same specimen, noted the larger heads and more numerous rays, and placed it in *H. inuloides* Cass. as a form. My examination of this specimen has led me to agree more closely with Rose. The variation described above includes this specimen and is geographically distributed in a manner to warrant its treatment as a variety.

Representative specimens. MEXICO: **Aguascalientes:** Aguascalientes, *Hartweg 109* (NY). **Colima:** Tonila, *Jones 268* (US). **Jalisco:** Guadalajara, *Runyon 1352* (US), *Palmer 268* (US), Mazamitla, *McVaugh 13078* (SMU), 3 mi. S. Mazamitla, *Wagenknecht 2842* (KANU). **Michoacán:** Hidalgo, *Hitchcock and Stanford 7186* (NY, UC, US), Tancitaro, *Hinton 15477* (GH, PH). **Nayarit:** Tepic, *Palmer 2020* (US). **Zacatecas:** Suchil, *Gentry 8557* (GH, UC).

3. **H. leptoglossa** DC., Prod. 5: 317. 1836

Annual aromatic herbs, 0.5-1 m. tall. Stems strict, striate, hispid to pilose, the hairs up to 2.5 mm. long. Leaves lanceolate to linear-lanceolate, entire to dentate to serrate, 1.5-8 cm. long, 0.2-3 cm. wide, pilose on upper and lower surfaces. Cauline leaves progressively smaller upwards, 1-5 cm. long, 0.3-2 cm. wide, becoming sessile, entire. Lower cauline leaves serrate, petiolate, the petioles 1-2 cm. long, expanded into auriculate, clasping bases. Inflorescence corymbose, the heads borne at the tips of elongate leafless peduncles, the peduncles 4-10 cm. long, the heads narrowly campanulate 0.5-1.2 cm. in diameter. Phyllaries closely imbricated in 4-6 series, the outer series 2.5 mm. long, 0.5-0.8 mm. wide, glabrous to sparsely pilose. Ray flowers 15-30, the corolla tube 3-6 mm. long, the ligules 4-6 mm. long; disk flowers 25-40, the tube 4-8 mm. long. Ray achenes epappose, 2.2-3.8 mm. long, trigonous, glabrous or with a few sericeous hairs on the angles. Disk achenes 2.4-4.2 mm. long, ovate, compressed, densely sericeous. Inner pappus of numerous barbellate bristles 3.4-5.6 mm. long, the outer squamellate-setaceous, or of short barbellate bristles 0.3-0.5 mm. long.

Receptacle flat, white, alveolate, the partitions terminated by unequal chartaceous points.

TIME OF FLOWERING: February to December.

TYPE AND TYPE LOCALITY: *Mendez*, Guanajuato, Guanajuato, Mexico. Isotype (GH). Holotype Genève: Conservatoire et Jardin Botaniques (G). Not seen.

DISTRIBUTION AND HABITATS: Aguascalientes, Chihuahua, Guanajuato, Sinaloa, and Sonora, Mexico. Sandy soil, milpas, waste places and roadsides.

Heterotheca leptoglossa is an infrequently collected species. It has been confused with *H. latifolia* but is differentiated from the latter by its narrowly lanceolate leaves and corymbiform inflorescence. It is most closely related to *H. inuloides*, from which it is distinguished by its annual habit, narrow leaves, smaller capitulae, and linear phyllaries.

Representative specimens. MEXICO: **Aguascalientes:** Pesa Calles, *Shreve 9279* (GH). **Chihuahua:** Guicorichi, Rio Mayo, *Gentry 1947* (F, GH, MO, NY, PH, US). **Guanajuato:** San Miguel Allende, *Kenoyer 2178* (NY). **Sinaloa:** Choix, *Goldman 252* (GH, NY). **Sonora:** Alamos, *Goldman 289* (GH, US).

4. **H. chrysopsidis** DC., Prod. 5: 317. 1836

Perennial aromatic herbs, 25-75 cm. tall, branching from a woody caudex 2.5 cm. in diameter. Stem striate, slender, hispid to pilose, the hairs up to 2.5 mm. in length. Leaves ovate to elliptical, entire to serrate, 0.8-4 cm. long, 0.6-3 cm. wide, pilose on upper and lower surfaces, the veins prominently raised. Lower and middle cauline leaves petiolate, the petioles 1.5-4 cm. long, expanded into auriculate clasping bases. Cauline leaves becoming progressively smaller upwards, 0.4-2 cm. long, 0.2-1 cm. wide, sessile, serrate to entire. Inflorescence paniculately corymbose, the heads borne at tips of long flowering branches, the involucres 1-2 cm. wide, 0.5-1.2 cm. high, the involucres hemispheric to broadly campanulate. Phyllaries in 4-6 series, the outer series 2-3 mm. long, the inner series 6-9 mm. long, sparingly pilose. Ray flowers 15-30, the corolla tube 4-5 mm. long, the ligules 3-8 mm. long; disk flowers 30-50, the tube 4-7 mm. long. Ray achenes 1.5-2.5 mm. long, epappose or with a few setaceous bristles, trigonous, glabrous or with a few sericeous hairs on the angles. Disk achenes 2.5-4.0 mm. long, ovate, compressed, densely sericeous. Inner pappus of numerous barbellate bristles 6-9 mm. long, the outer series squamellate-setaceous, or of short barbellate bristles 0.2-0.4 mm. long. Receptacle flat, white, alveolate, the partitions terminated by unequal chartaceous points.

TIME OF FLOWERING: February to December.

TYPE AND TYPE LOCALITY: *Berlandier 109* "Circa Saltillo," Mexico. Isotypes (F, GH, NY, PH); photographs of holotype (F, US). Holotype, Genève; Conservatoire et Jardin Botaniques (G). Not seen.

DISTRIBUTION AND HABITATS: Saltillo east to southern Nuevo León, Mexico. Sandy soils, fields, and roadsides, 1,000 to 3,000 feet.

De Candolle's (1836) description of *H. chrysopsidis* states that the ray achenes bear pappi. This characteristic led him to consider the species to be intermediate between *Heterotheca* and *Chrysopsis*. He described *Heterotheca* Section 1, *Chaetactis*, containing only this species. An examination of isotypes (F, GH, NY, PH) show that the character was not present throughout the type collection. In specimens of *H. chrysopsidis*, as in most other species, one finds a crown or a few caducous bristles present on the ray achenes. The characteristic is not distinctive enough to be used as a species character, or as a sectional character.

Representative specimens. MEXICO: **Coahuila:** Parra, *Johnston 7707* (GH); Saltillo, *Palmer 492* (GH, NY, PH, US). **Nuevo León:** Galeana, *Chase 7670* (F, GH, MO, NY); 6 mi. below Iturbide, *Shreve and Tinkham 9788* (GH); Monterrey, *Palmer 481* (GH). **Tamaulipas:** San Jose, *Bartlett 10277* (GH, US).

5. **H. subaxillaris** (Lam.) Britton & Rusby, Trans. N. Y. Acad. Sci. **7**: 10. 1887

Annual or biennial aromatic herbs, procumbent to one m. tall. Stem striate, slender, scabrous to strigose to hispid, the hairs up to 2 mm. long. Leaves ovate to elliptical or lanceolate, entire to dentate to serrate, 1-5 cm. long, 0.4-1.5 cm. wide, scabrous on both surfaces. Cauline leaves 0.3-1.8 cm. wide, 1-2.5 cm. long, becoming progressively smaller upward, sessile, serrate to entire. Lower cauline leaves petiolate, the petioles 1-2 cm. long with enlarged auriculate-clasping bases often present. Inflorescence a loosely spreading or divaricate corymbose panicle; terminal involucres 0.6-1.5 cm. wide, 4-8 mm. high, campanulate to hemispherical. Phyllaries in 4-6 series, the tips villous, the inner series 4-8 mm. long, glabrous on inner face, bearing a tuft of short, thick hairs on outer face, the outer series 1-3 mm. long, glabrous on inner surface, bearing a well defined tuft of short thick hairs on outer face. Ray flowers 15-35, the corolla tube 2-4 mm. long, the ligule 3-5 mm. long; disk flowers 35-40, the tube 2-3 mm. long, glabrous. Ray achenes 1.6-3.1 mm. long, trigonous, epappose, glabrous or slightly sericeous. Disk achenes 1.4-3.0 mm. long, obovate, compressed, densely sericeous. Pappus of two series, the inner series of numerous barbellate bristles, 3.8-5.5 mm. long, reddish brown to white, the outer series squamellate-setaceous or of short barbellate bristles 0.2-0.4 mm. long, white or occasionally reddish brown. Receptacle flat, white, alveolate, the partitions terminated by unequal chartaceous points.

5a. **H. subaxillaris** var. **subaxillaris**

Inula subaxillaris Lam., Encyc. Méth. Bot. **3**: 259 col. 2. 1789.
Inula punctata Muhl., Cat. 76. 1813.
Inula scabra Pursh, Fl. Amer. Sept. **2**: 531. 1814.

Heterotheca lamarckii Cass., Dict. Sci. Nat. **21**: 131. 1821.
Chrysopsis scabra (Pursh) Ell., Sk. **2**: 339. 1823.
Heterotheca scabra (Pursh) DC., Prod. **5**: 317. 1836.
Stelmanis scabra (Pursh) Raf., Fl. Tellur. **2**: 47. 1836.
Chrysopsis lamarckii (Cass.) Nutt. Trans. Am. Philos. Soc., Ser. II, **7**: 315. 1841.
Heterotheca scabra, alpha calycium Torr. & Gray, Fl. N. Am. **2**: 251. 1843.
Heterotheca scabra, beta nuda Torr. & Gray, Fl. N. Am. **2**: 251. 1843.

Habit erect, leaves serrate, lateral veins prominent.

TIME OF FLOWERING: July to November, New Jersey to Georgia; throughout year along Gulf Coast.

TYPE AND TYPE LOCALITY: *D. Walter*, Carolina. Muséum National d'Histoire Naturelle, Paris (P). Photograph, Dr. G. H. M. Lawrence, Bailey Hortorium.

DISTRIBUTION AND HABITATS: Atlantic and Gulf Coasts from Delaware to northeastern Mexico. Sand dunes, beaches, fields and roadsides.

Shinners (1951) has dealt with the nomenclatural complexities of this species in some detail. For this reason this paper will deal quite briefly with the nomenclatural history.

Lamarck's (1789) description is somewhat vague and on its own would scarcely distinguish this species from several others in related genera. No indication is given as to where he acquired his specimen. The type specimen (P) bears only the notation "Walter, Carolina" and the reference to the Plukenet plate. This plate is not sufficiently detailed to make positive the identification of the species illustrated. Although unable to acquire the type on loan, I was able to make a positive identification of the type through the cooperation of Dr. Porterès of the Muséum National d'Histoire Naturelle and Dr. G. H. M. Lawrence, Bailey Hortorium, Ithaca, New York. Dr. Porterès sent portions of the type for study and compared material sent to him with the type, thus settling many questions. Dr. Lawrence kindly loaned me a photograph of the type which allowed a comparison of the habit of the type with specimens from herbaria in the United States. The results of this study showed that the type of *Inula subaxillaris* Lam. is a *Heterotheca* and is properly the type of the species now known as *Heterotheca subaxillaris* (Lam.) Britt. & Rusby. The suspicions of Cassini (1821) and De Candolle (1836) that the type of *Inula subaxillaris* was not a *Heterotheca* are thus shown to be baseless.

Inula punctata Muhl. (1813) referred to by Elliott and De Candolle as a synonym of *Inula scabra* Pursh is a *nomen nudum* and need not be considered for this reason, as well as for its lack of priority.

Inula scabra Pursh (1814) is illegitimate under Article 60 of the Rules of Nomenclature, since he cited *Inula subaxillaris* Lam. as a synonym. *Chrysopsis scabra* (Pursh) Ell. (1823), *Heterotheca scabra* (Pursh) DC. (1836) and *Stelmanis scabra* (Pursh) Raf. (1836) are all transfers of Pursh's illegitimate epithet and consequently are also illegitimate. De Candolle erroneously attributed the epithet to Nuttall (1818) in his transfer. Nuttall does not mark this species with an asterisk, as he did his own, and though there is no reference to Pursh under the species, he does comment in the introduction to Volume 1 (p. vii), "A brief Catalogue of the species is offered, which may be considered as supplementary to the recent and extensive Flora of North America by Frederick Pursh." It can be concluded therefore that Pursh is the author of the name.

In his description of *Heterotheca lamarckii*, Cassini (1821) cited *Inula subaxillaris* as a synonym and thus this name is also illegitimate according to Article 60. The binomial *Chrysopsis lamarckii*, created by Nuttall's (1818) transfer of this epithet, is also illegitimate.

The presence or absence of a crown on the ray achene is a character which not only occurs sporadically throughout most colonies, but one which may appear in either form in different heads of the same plant. The geographic distribution given by Torrey and Gray (1843) was not found in the large number of specimens examined in the course of this study. Under these conditions, both varieties *calycium* and *nudum* are considered ephemeral variants not worthy of formal recognition.

It is interesting to note that the transfer of the name of the type species to the genus *Heterotheca* as *H. subaxillaris* did not occur until seventy years after the description of the genus.

Representative specimens. **New Jersey:** Camden Co.: Camden, *Parker* (GH). **Pennsylvania:** Navy Yard, Philadelphia, *Canby* (F, NY). **Delaware:** New Castle Co.: *Wood* (US); Sussex Co.: *Williamson* (PH).

Virginia: Princess Anne Co.: Cape Henry, *Egler 40-245* (NY). **North Carolina:** Carteret Co.: Bogue, *Godfrey 5836* (GH, US); New Hanover Co.: Carolina Beach, *Batchelder* (GH). **South Carolina:** Beaufort Co.: *Cuthbert* (NY); Charleston Co.: Isle of Palms, *Clausen & Trapido 3574* (CU, NY, UC); Georgetown Co.: South Island, *Godfrey & Tryon 1565* (CU, F, NY, UC, US). **Georgia:** Chatham Co.: *Githens* (PH); Decatur Co.: *Brinson, Thorne 7636* (CU); Glynn Co.: Sea Island, *Cronquist 5436* (NY, US). **Florida:** Alachua Co.: Gainesville, *Demaree 10160* (CU); Brevard Co.: Rock Ledge, *Bartram* (PH); Collier Co.: Marco, *Deam 60577* (SMU); Dade Co.: Buena Vista, *Moldenke 5533* (NY); Duval Co.: Jacksonville, *Curtis 1358* (CU, F, KANU, NEB, NY, P, PH, SMU, US); Franklin Co.: St. George Island, *Gauman* (NY, PH, UC); Gulf Co.: St. Vincent, *Tracy 6359* (CU, NEB, NY, US); Hernando Co.: Brooksville, *Jones 28* (CU, US); Hillsborough Co.: Davis Island, *Perkins 860* (CU); Lake Co.: Eustis, *Nash 1718* (CU, F, NEB, NY, P, PH, UC, US); Lee Co.: Fort Meyers, *Standley 139* (F, NY, PH, US); Levy Co.: Cedar Keys, *Miller 333* (US); Liberty Co.: 6 mi. E. Appalachicola, *Sargent 6238* (SMU); Orange Co.: Lake Jovita, *O'Neill* (US); Palm Beach Co.: Gulfport, *Pilsbury* (CU); Putnam Co.: *Johnson and Barnhart 2316* (NY); St. Johns Co.: Anastasia Island, *Perkins 861* (CU); Volusia Co.: Tampa, *Degener 5182* (NY). **Alabama:** Mobile Co.: *Mohr* (US). **Mississippi:** Hancock Co.: *Demaree 29612* (TEX); Harrison Co.: *Bartram* (PH). **Louisiana:** Cameron Parish: *Correll 9607* (NY). **Texas:** Cameron Co.: Del Mar, *Cory* (GH); Chambers Co.: *Tharp 3191* (TEX, US); Galveston Co.: *Fisher 654* (NY); Kleberg Co.: Padre Island, *Cory 49139* (NY); Nueces Co.: Mustang Island, *Warnock 21340A* (TEX).

5b. **H. subaxillaris** var. **procumbens** var. nov.

Planta prostrata, foliorum laminis integris pauciserratisque, nervis lateralibus obscuris.

Habit procumbent, the leaves entire to remote-serrate, the lateral veins obscure.

TIME OF FLOWERING: Throughout the year.

TYPE AND TYPE LOCALITY: *R. M. Harper 3801*, on flattish dunes about a mile southwest of Dauphin Island Post Office, Mobile Co., Alabama, (GH). Isotypes (F, NY, PH, US).

DISTRIBUTION AND HABITATS: Eastern Florida to northeastern Mexico. Exposed beaches and drifting sand.

The type specimen was selected because it is typical of the variety and because it was distributed to a number of herbaria.

Representative specimens. **Florida:** Brevard Co.: Cape Canaveral, *Burgess 683* (NY). **Alabama:** Mobile Co.: 1 mi. southwest of Dauphin Island Post Office, *Harper 3801* (F, GH, NY, PH, US). **Mississippi:** Hancock Co.: Bay Saint Louis, *Munz* (CU); Harrison Co.: Mississippi City, *Lloyd & Tracy 532* (NY); Jackson Co.: Horn Island, *Tracy 4345* (NY). **Louisiana:** Cameron Parish: *Reed 218* (US); Saint Bernard Parish:

Breton Island, *Tracy* (F, GH, US). **Texas:** Cameron Co.: Padre Island, *Johnston 54205* (TEX); Brazoria Co.: Freeport Beach, *Killip 43295* (TEX, US); Galveston Co.: Galveston Island, *Turner 1748* (SMU); Nueces Co.: Corpus Christi, *Tharp, Johnson and Weber 48-109* (TEX). MEXICO: **Tamaulipas**, south of Rio Grande, *Leseur 469* (US).

6. **H. psammophila** sp. nov.

Annua aromatica 0.5-2.0 m. alta. Caulis robustus ca. 8-12 mm. diametro striatus hispidulus vel pilosus. Folia plus minusve pilosa; infirma ovata, serrata, 4.5-7.0 cm. longa, 3.0-5.5 cm. lata, petiolis 1-2 cm. longis basin versus auriculatis; foliis caulinis lanceolatis integris vel serratis, 2-9 cm. longis, 0.5-3.0 cm. latis. Inflorescentia paniculato-corymbosa; capitula pedunculos nudos terminantia. Involucrum 0.8-1.2 cm. altum, 1.3-1.7 cm. latum, rotundato- vel lato-campanulatum. Phyllaria 4-6-seriata pilosa denseque glandulosa, exteriora 4-5 mm. longa, interiora 8-12 mm. longa. Flores radiati 20-30, corollae tuba 3-7 mm. longa, achaenia trigona 2.4-3.8 mm. longa epapposa glabra vel margine minute sericea. Flores discoidei 25-45, corollae tuba 5-9 mm. longa, achaenia obovata compressa 2.6-4.2 mm. longa dense sericea; pappis interioribus pilis, 6-9 mm. longis, barbellatis, dilute ferrugineis, exterioribus squamellatis, setaceis, vel nitis barbellatis dilutis ferrugineis. Receptaculum planum album denticulato-alveolatum.

Annual, aromatic herbs, 0.5-2 m. tall. Stem robust, 8-12 mm. in diameter, striate, hispid to pilose, the hairs up to 2.5 mm. in length. Leaves ovate to lanceolate, entire to serrate, sparsely pilose on upper and lower surfaces. Lower cauline leaves ovate, the lamina serrate, 4.5-7.0 cm. long, 2.0-5.5 cm. wide, petiolate, the petioles 1-3 cm. long, expanded into auriculate clasping bases. Middle and upper cauline leaves lanceolate, entire to serrate, 2-9 cm. long and 0.5-3 cm. wide, becoming cordate above. Inflorescence paniculate-corymbose, the heads terminal on leafless peduncles, the heads 1.3-1.7 cm. wide, 0.8-1.2 cm. high, hemispheric to broadly campanulate. Phyllaries in 4-6 series, the outer series 4-5 mm. long, the inner series 8-12 mm. long, pilose and densely glandular. Ray flowers 20-30, the corolla tubes 3-6 mm. long, the ligules 3-7 mm. long, the disk flowers 25-45, the tubes 5-9 mm. long, glabrous. Ray achenes 2.4-3.8 mm. long, trigonous, epappose, glabrous or more commonly sparsely sericeous on the angles. Disk achenes 2.6-4.2 mm. long, ovate, compressed, densely sericeous. Pappus of two series, the inner series of numerous barbellate bristles, 6-9 mm. long, tan; outer series squamellate-setaceous or of barbellate bristles 0.2-0.6 mm. long, tan. Receptacle flat, white, alveolate, the partitions terminated by unequal chartaceous points.

TIME OF FLOWERING: July to December.

TYPE AND TYPE LOCALITY: *B. L. Wagenknecht 4824*, sandy soil along edge of roadside ditch, 1 mi. s. Sedona, Yavapai Co., Arizona, August 23, 1957. (KANU).

(to be continued)

CROTON SUAVEOLENS AND CROTON ABRUPTUS (EUPHORBIACEAE) OF WESTERN TEXAS AND NORTHERN MEXICO

MARSHALL C. JOHNSTON

The study of plants previously referred to *Croton suaveolens* Torrey (Ferguson, 1901: 43; Standley, 1923: 616) reveals that two species are involved, adding one more species to the eighteen reported for Texas (Johnston, 1959). The following key will serve to point up the differences.

Flowers monoecious (plants rarely appearing unisexual); racemes usually androgynous, and always terminal; internodes about a third as long as the mature subtending leaves, and petioles about a fourth to two-fifths as long as their blades; capsules 6-8 mm. long; seed 5.5-6.5 mm. long; stamens 14-16; staminate calyxes ca. 6 mm. across ..... *C. suaveolens* Torrey.

Flowers dioecious; staminate plants with terminal racemes; pistillate plants with axillary racemes; internodes about half as long as the mature subtending leaves; petioles about a tenth to a fifth as long as their blades; capsules 5.5-6 mm. long; seed 4.4-4.7 mm. long; stamens 9-12; staminate calyxes ca. 4 mm. across ..... *C. abruptus* M. C. Johnston.

Croton suaveolens Torrey, Bot. Mex. Bound. p. 194, 1859.

"On the Rio Grande," *Wright exs. 1804* (NY?; apparent isotypes seen; GH, US).

Low stellate-tomentose hemispheric shrubs 20-35(-50) cm. tall; taproot 4-18 mm. thick, woody, with a brown to black bark with shallow longitudinal fissures; stems many, much-branched, 1.5-8 mm. thick, the older ones glabrate with a thin fuscous minutely longitudinally fissured bark; leafy branches (yearling twigs) 1.5-3 mm. thick, 8-20 cm. long, terete, densely and shaggily pale grayish to yellowish stellate tomentose; internodes short, 0.2-1 cm. long, the leaves thus somewhat crowded toward the ends of the branches. Leaves alternate or occasionally nearly opposite (very rarely in a whorl of 3) near the base of the racemes; blades rather thick, obovate or ovate or broadly elliptical, 2.0-5.4 cm. long, 1.0-3.6 cm. broad, about twice or a little less than twice as long as broad, broadest near the middle, rounded, obtuse and apiculate or angled apically (90-120°), narrowed or rounded basally, entire marginally, densely and shaggily grayish stellate tomentose below, less densely tomentose and pale olive-green above; petioles 5-20 mm. long, stout and tomentose like the stems; stipules a little longer than the tomentum, stramineous (young) to brownish (mature), of 5-10 unequal glandular papillae each 0.2-0.5 mm. long and bearing a few stellate trichomes, arranged palmately on a thin disk ca. 0.3 mm. in diameter. Flowers monoecious; racemes terminal, generally androgynous, 1-2(-2.5) cm. long, stout, rather densely

flowered. Staminate flowers 4-12 at top of raceme; bracts 0.7-0.8 mm. long, linear, subulate, tawny, stellate-hairy with 2 glandular pinnate stipular lobes smaller than the main portion; pedicels 3-5 mm. long (to 8 mm. long says Ferguson, but Torrey says the flowers are sessile), stellate-tomentose, ascending; calyx stellate-tomentose, limb cupped, ca. 2 mm. across, the 5 sepals ovate, ca. 2 mm. long; petals tawny, thin, 5, spatulate or obovate, densely villous at least marginally and basally, slightly longer than and alternate with the sepals; glands rather small, tawny, ca. 0.2 mm. long, narrowly oblong; stamens 14-16 (Torrey says 12-14, but most plants show 16 in the field); filaments densely villous basally, mostly smooth above; center of flower raised and densely villous. Pistillate flowers 2-4 at base of raceme, often 2-3 maturing fruit on each raceme; raceme axis stout, buttressed; bracts tawny, stellate-hairy, usually 3-lobed, the lobing pinnate or appearing palmate, linear subulate, or the lateral (stipular) lobes glandular, the middle one ca. 1.2 mm. long; pedicels 1-2 mm. long, stout, apparently accrescent to 3-4 mm. long, erect; calyx stellate-tomentose, not at all accrescent, deeply 5-lobed, the sepals thick, united only at base, lanceolate or narrowly triangular acuminate, ca. 2.5 mm. long; petals reduced to mere stalked glandular papillae between the sepals; glands of the disk thin, narrow, elongate, brownish; ovary subglobose, densely stellate-tomentose; styles 3, 4-6 mm. long, bifid to the base, stellate-tomentose, the divisions slender, purplish brown and grooved adaxially. Capsules oblong to subglobose, truncate at both ends, obscurely 3-lobed apically, 6-8 mm. long, 6-8 mm. broad, usually longer than broad, densely and shaggily yellowish or whitish stellate-tomentose; columella (5-)6-7.5 mm. long, rather stout, abruptly broadened at the summit into 3 sharp projections. Seeds roundly oblong, apiculate, dorsiventrally flattened, 5.5-7 mm. long including caruncle, grayish mottled fuscous or black when fully mature, rather shiny, smooth or with microscopic roughening; caruncle reniform, whitish vesicular, 2.5 mm. wide, 1 mm. long.

In Texas these plants are known only from the immediate vicinity of Fort Davis in Jeff Davis County, from bluffs and grassy slopes of an old decomposing lava with a high sanidine content. Nine collections have been seen from that neighborhood, and numerous plants have been studied in the field there.

The Coahuilan collections are here cited: San Lorenzo canyon, 6 miles southeast of Saltillo, *E. Palmer 390*, Sept. 21-22, 1904 (US); Sierra de la Paila, *Purpus 5040*, Oct. 1910 (US); El Berrendo near Muzquiz, elev. 4000 ft., *S. S. White 1802*, July 13-16, 1939 (GH, US); 5 miles northwest of Puerto del Aire pass at the southern end of Sierra de la Encantada, *Stewart 1300*, Sept. 1, 1941 (GH); western slopes of Sierra del Carmen 10 kilometers east of Hacienda de la Encantada, *Stewart 1679*, Sept. 15, 1941 (GH); 9 kilometers south of Parras on Sierras Negras, *Stanford, Retherford & Northcroft 214*, July 3, 1941

(GH, MEXU); Sierra de la Madera, vicinity of La Cueva in Corte Blanco fork of Charretera canyon, elev. 5300-6500 ft., *I. M. Johnston 8955*, Sept. 11-15, 1941 (GH); Sierra de Santa Rosa, south of Muzquiz, *Marsh 1385*, July 14, 1938 (GH); Sierra del Pino, vicinity of La Noria, end of road from T. Armendariz north into the Sierra del Pino, *Johnston & Mueller 519*, Aug. 20-26, 1940 (GH).

Croton abruptus M. C. Johnston, new species.

Fruticulus ad 40 cm. alt., e radice terete oriens; caules 10-35 e corona crescentes; ramosissimi, ramulis frondosis subflavis, stellato-tomentosis; laminae foliorum ovatae ad elliptico-ovatas, 1-3(-4.5) cm. long., 0.5-1.5(-1.9) cm. lat., ca. 2 plo longiores quam latae, integrae, dense tomentosae, in superficie superiore minus dense; petioli 2-3(-4.5) mm. long.; stipulae 0.1 mm. long. glanduliformes; flores dioecii, staminei petaliferi, pistillati non petaliferi; racemi staminei terminales, 0.5-1 cm. long.; pistillati plerumque 2 flores habentes, 1-3 mm. long. ut videtur axillares, plerumque uno tantum ovario racemi maturescente; styli 3, usque ad basim bifidi; capsula globosa, 5.5-6 mm. long.; semen rotundo-ovatum, 4.4-4.7 mm. long. fuscum fulgens laeve; caruncula reniformis, ca. 0.8 mm. long.

Low, stellate tomentose shrubs 10-30(-40) cm. tall; taproots terete, 3-8(-13) mm. thick, occasionally branching but usually simple, slenderly napiform, with a dark brownish bark nearly smooth or with faint vertical lines; stems several to many (10-35) from the enlarged woody crown, ascending, terete, 1-3 mm. thick, 10-25(-35) cm. tall altogether, much-branched, the angles of divergence of the branches 10-40°; stems often not persistent more than one or two years and not acquiring a thick bark; oldest stems eventually with a gray to black faintly vertically fissured bark; leafy branches yellowish, densely and somewhat shaggily stellate-tomentose, the internodes a sixth to about as long as their subtending leaves. Leaves alternate; blades ovate to elliptic-ovate, 1-3(-4.5) cm. long, 0.5-1.5(-1.9) cm. wide, about twice as long as broad or a little more, widest just below the middle, apically acute or rounded, basally rounded or occasionally narrowed, marginally entire, densely and shaggily canescent stellate-tomentose below, less densely tomentose and greener above; venation pinnate, but often obscured by the tomentum, the midvein prominent beneath, the laterals 5-6 on each side diverging at angles of 40-50°; petioles stout, densely shaggily stellate-tomentose, 2-3(-4.5) mm. long, much shorter than the blades; stipules 0.1 mm. long, dark brown or black, glabrous, shiny, papillose-glandular, obtuse-pyramidal, entire, usually hidden by the trichomes. Flowers dioecious. Staminate flowers several in slender terminal racemes 0.5-1 cm. long, the axis pubescent like the stem with internodes ca. 1 mm. long; pedicels 1 mm. long or less, stellate-tomentose, subtended by triangular-ovate acute bracts less than 1 mm. long; calyxes hemispheric or broadly campanulate, whitish or yellowish stellate-tomentose, with 5 (rarely 4) triangular acute

lobes, 2 mm. from the attachment of the pedicel to the tip of the lobe, the limb comprising about half that length; petals 5 (rarely 4), narrowly oblanceolate or somewhat unguiculate, alternate with calyx lobes and reflexed between them at anthesis, 1.8-2 mm. long, hyaline, whitish; glands 5, orangish, 0.2 mm. long, oblong or rounded, opposite the calyx lobes; stamens 9-12 (usually 11 counted in the field), the filaments glabrous and strongly inflexed in bud, 1.9 mm. long; center of flower raised and densely villous. Pistillate flowers usually 2, rarely 3, in racemes 1-3 mm. long; racemes actually terminal and quickly surpassed by a branch from the axil of the subtending leaf, but appearing therefore nodal or axillary; only one flower per raceme maturing fruit; bracts simple, subulate, 0.5-1 mm. long, stellate-tomentose abaxially; pedicels absent or very short; calyx deeply 5-lobed, shaggily stellate-tomentose outside, the limb cupped, ca. 1.7-1.9 mm. across, sepals ca. 1 mm. long, not at all accrescent, acute; glands 5, opposite the sepals, narrowly elongate, purplish brown; petals absent or only the merest glandular rudiments present; ovary globose, densely and shaggily stellate-tomentose; styles 3, ca. 1.5-2 mm. long, each bifid to the base, the divisions slender, divergent, purplish-brown, grooved ventrally, stellate-tomentose dorsally at the base. Capsules globose or somewhat 3-lobed toward the summit, densely and shaggily whitish or yellowish-green stellate-tomentose, 5.5-6 mm. long, columella 3.8-4.5 mm. long. Seeds plump, rounded, ovoid, slightly compressed ventrally, grayish or fuscous mottled black, shiny, smooth or with obscure irregular low rounded tubercles microscopically, 4.4-4.7 mm. long, including the caruncle; caruncle prominent, broadly reniform, whitish vesicular, ca. 0.8 mm. long. TYPE: Presidio County, Texas, limestone hill a quarter of a mile north of Solitario Peak, in lechuguilla, lat. 29°28′ N. by 103°50′ W., alt. 4600 ft., *M. C. Johnston 3441* (pistillate), Oct. 12, 1958 (holotype, SRSC; isotypes, TEX, US, GH, et al.). The staminate paratypes, from the same locality, are *Johnston 3440* (same herbaria).

These plants do not show much restriction as far as soils are concerned, having been found on limestone, novaculite (bedded cherty rock), and basic igneous crystallines; their elevational range is about 3800 to 4800 feet; they occur in desert scrub. All the specimens seen other than the type are cited.

TEXAS. **Brewster County**: without locality other than county, *Cory 1881*, April 25, 1928 (GH); 18.5 miles south of Marathon, *Cory 6910*, Sept. 6, 1933 (GH); frequent perennials, crevices, igneous rocks, Agua Fria Mountain, alt. 4500 ft., *B. L. Turner 1323*, July 31, *1949* (SRSC, SMU, pistillate only); infrequent, protected canyon in novaculite hills 16 miles south of Marathon, alt. 3800 ft., *Warnock 6121*, June 29, 1947 (SRSC, staminate, pistillate on same sheet); frequent perennial, rocky novaculite hills, 21 miles south of Marathon, alt. 3850 ft., *Warnock*

15895, April 1, 1958 (SRSC, staminate only); novaculite hills 12 miles south of Marathon, elev. 3900 ft., abundant low shrubs, *M. C. Johnston 3605, 3606, 3607* (pistillate, sun and shade forms), and *3608, 3609, 3610* (staminate, sun and shade forms), Nov. 5, 1958 (SRSC, et al.). **Presidio County:** small, west-flowing canyon in Glen Rose limestone, northwest of Solitario Peak, lat. 29°27½′ N. by 103°51½′ W., alt. 4200-4300 ft., *M. C. Johnston 3463*, Oct. 12, 1958 (SRSC, pistillate).

CHIHUAHUA: rocky hills near Chihuahua, *Pringle 140*, May 23, 1885 (GH, US); Santa Eulalia hills about 13 miles east-southeast of Chihuahua, *Wilkinson s. n.*, July 30, 1885 (US); vicinity of Chihuahua, alt. ca. 1300 meters, *E. Palmer exs. 73 & 77*, April 8-27, 1908 (GH, US); vicinity of Chihuahua, alt. ca. 1300 meters, *E. Palmer exs. 368*, June 5-10, 1908 (GH, US); Sierra Azul (Sierra Mapula) ca. 15 miles south-southeast of Chihuahua, shrub at base of cliff, elev. 1600-1700 meters, *F. W. Pennell 18664*, Sept. 10, 1934 (US, PH, MEXU).

During the preparation of this paper, Dr. Barton H. Warnock of Sul Ross State College, Alpine, Texas, has given generously of his incomparable knowledge of the flora of western Texas. I am further indebted to the staffs of the herbaria visited (cited above according to Lanjouw and Stafleu, 1959) for their help, and to Hannah Croasdale of Dartmouth College for work on the Latin diagnosis. — THE UNIVERSITY OF TEXAS, AUSTIN.

LITERATURE CITED

FERGUSON, A. M. 1901. Crotons of the United States. Ann. Rept. Mo. Bot. Gard. **12**: 33-74.

JOHNSTON, M C. 1959. The Texas species of Croton (Euphorbiaceae). S. W. Nat. **3**: 175-203.

LANJOUW, J. AND F. A. STAFLEU 1959. The Herbaria of the World, 4th ed. Index Herbariorum, pt. 1, pp. 1-249.

STANDLEY, P. C. 1920-1926. Trees and Shrubs of Mexico. Contr. U. S. Natl. Herb. **23**: 1-1721. *Croton*, 1923, pp. 610-620.

DATES OF PUBLICATION OF GÄRTNER'S DE FRUCTIBUS ET SEMINIBUS PLANTARUM

GEORGE K. BRIZICKY

Despite extensive research in botanical bibliography, there are still many works, the exact publication dates of which are doubtful. Among these works is Gärtner's *De fructibus et seminibus plantarum*. Below are some notes which it is hoped will clarify the dates of appearance of this important taxonomic reference.

Pritzel (Thesaurus lit. bot. ed. 2. p. 116. 1872) cites the two volumes of Gärtner's work as appearing in 1788 and

1791 respectively. Van Steenis-Kruseman and Stearn in *Flora Malesiana* (Ser. 1. 4(5) : p. CLXXXIII. 1954) refer to Burtt's study (Kew Bull. p. 148. 1951) and merely state that volume 1 of *De fructibus* antedates part 1 of volume 3 of Lamarck's *Encyclopédie méthodique* (1789) and that volume 2 of Gärtner precedes part 2 of volume 3 of Lamarck (1791-1792). Actual publication dates for Gärtner's work are not cited. Burtt (l. c.) presents proof for the above statement and quotes 1789 as the publication date for volume 1 of *De fructibus* and 1791 as the issue date for volume 2 of Gärtner's work. Although 1789 is the correct year of effective publication for volume 1 of Gärtner, there are certain circumstances surrounding the issuance of this volume which should be brought to light. This, to avoid discrepancies in the future. The story of the publication of volume 1 of *De fructibus*, based on various announcements and reviews, is about as follows:

In the first quarter of 1788, the Cotta Booksellers of Tübingen, agents for Gärtner, announced the appearance of the first volume of Gärtner's *De fructibus* in the "Leipziger Oster-Messe Verzeichnis."

On 10 August 1788, the Cotta Booksellers advised the "Intelligenzblatt der Allgem. Literatur-Zeitung"[1] (No. 44. p. 377-378) as follows: "*Der erste Theil der im letztern Leipziger OM. Verzeichnis angekündigten Werks des Hrn. D. Harter* (sic!) *de fructibus et seminibus plantarum 3 Alph. in gr. 4 mit Kupf. wird, verschiedener Hindernisse wegen, erst in einigen Monaten fertig.*" A very brief review of this volume, probably written by Gärtner, was added.

In the October 1788 issue of "Observations et mémoires sur la physique, l'histoire naturelle . . ." (33: 324-325), a review of volume 1 of *De fructibus* appeared. The report was relatively brief, Gärtner was misspelled as Gaestner, and 14 chapters comprising 384 pages were cited correctly.

On 1 March 1789, in the "Intelligenzblatt" (No. 34. p. 267-268) cited above, the Cotta Booksellers entered an an-

[1] The publication known as the "Allgemeine Literatur-Zeitung" was issued in two sections: the "Zeitung" proper, and the "Intelligenzblatt" or intelligencer. The latter was devoted to announcements of new books.

nouncement identical to that of 10 August 1788. Here Gärtner was spelled correctly.

A review of volume 1 of *De fructibus* appeared on 28 May 1789 in the "Göttingische Anzeigen von gelehrten Sachen" (No. 85. p. 850-854). The "Allgemeine Literatur-Zeitung" (No. 246. p. 417-424) also carried a review in the 15 August 1789 issue.

Persuing the above, the reader can see from the announcements of Cotta Booksellers, and the review in the "Göttingische Anzeigen," that the completion of the first volume of *De fructibus*, and its appearance at booksellers, did not occur until April or early May 1789.

The review in "Observations et mémoires" (October 1788) is puzzling. However, it seems to be easily explainable as follows:

(1) It appears that the text for volume 1 of *De fructibus* had already been printed at the time of the review in the "Observations," as the reviewer cites the exact number of pages — 384.

(2) It is probable that Gärtner expected completion of volume 1 by that time (Cotta announcement of 10 August 1788) and wrote the above-mentioned review (perhaps "announcement"?) for the "Observations."

(3) Whatever obstacles prevented the appearance of *De fructibus* as twice announced by Cotta in 1788, probably pertained to the issuance of the copper engravings, not the text.

It is highly improbable, however, that the text to the first volume became accessible to botanists before completion of the volume, i. e., before April or early May 1789. Therefore, the latter date must be accepted as the date of effective publication for Gärtner's new taxa in the first volume of *De fructibus*.

Both Burtt (Kew Bull. 1951) and Pritzel (Thesaurus lit. bot. ed. 2. 1872) mention 1791 as the publication date for volume 2 of Gärtner's *De fructibus*. This date is only partially correct as the volume was published in installments.

On 26 August 1790 Gärtner announced in the "Intelligenzblatt der Allgem. Literatur-Zeitung" (No. 116. 6. 953-954): "*Den zweyten Theil aber gedenke ich in drey Lieferungen*

auszugeben, woran die erste, von 1 Alph. und 40 Kupf. innerhalb zwei Monaten; die zweyte, von ungefähr gleicher Bogenzahl mit 37 Kupf. gleich nach dem neuen Jahr; und die dritte, von etwa 1 ½ Alph. nebst 23 Kupf. mit oder bald nach der nächsten Oster-Messe um so gewisser erscheinen soll, als von den sämtlichen Kupfer-Platten bereits schon 66 Stück fertig sind."

A review of the incomplete second volume of *De fructibus* appeared on 25 August 1791 in the "Göttingische Anzeigen von gelehrten Sachen" (No. 136. p. 1367-1368) where we read: *"Von dem vertrefflichen Werke des kürzlich verstorbenen Prof. Gärtner haben wir noch 1790 das sechste und siebente S. 1-184, Pl. 80-119. und 1791 das achte und neunte Hundert S. 185-352. Pl. 120-156. erhalten . . ."*

In the announcement of Cotta which appeared in the "Intelligenzblatt der Allgem. Literatur-Zeitung" (No. 24. p. 186) on 23 February 1791, Centuria 6 and 7 of *De fructibus* were listed among books published after Easter 1790, and Centuria 8-10a among books to appear before Easter 1791.

The edition of Centuria 10 had apparently been delayed and this part of Gärtner's work seems to have appeared not earlier than in the second half of 1791. The earliest review of the complete second volume *De fructibus*, known to the writer, is that in the "Allgemeine Literatur-Zeitung" (No. 98. p. 97-103) of 16 April 1792.

We can conclude therefore, that Gärtner's work, *De fructibus et seminibus plantarum* was published as follows:

Volume 1:		April or early May 1789
Volume 2:	Centuria 6 and 7: 1-184, pl. 80-119.	October or November 1790
	Centuria 8 and 9: 185-352, pl. 120-156.	Probably April, but not later than early August 1791
	Centuria 10: 353-520, pl. 157-180.	Probably the second half of 1791.

— S. J. RECORD MEMORIAL COLLECTION, SCHOOL OF FORESTRY, YALE UNIVERSITY, NEW HAVEN, CONNECTICUT.

THE COMING OF AGE OF AMERICAN BOTANY.[1] — Asa Gray was instrumental in creating two big revolutions which took place in American botany during the nineteenth century. As a young graduate, while still a country doctor, together with his friend and teacher John Torrey, he championed in this country the natural systems of Lindley, De Candolle, and others, over the artificial Linnean system which Amos Eaton had divulgated and maintained. The final adoption by the botanical world of the natural systems brought Gray into prominence.

The second big turning point in Gray's career came with Charles Darwin and the "Origin of Species". Gray had been Darwin's American correspondent for some years before the publication of the "Origin" and had supplied Darwin with important facts especially concerning the Asiatic-American floristic relationships. In turn he became one of the few members of the Darwinian "inner circle" and was introduced to evolutionary theory before the rest of the world. This made Gray the natural candidate to explain evolution to the American public. In the many discussions and debates which took place, Gray presented an objective view of Darwinism, but without ever becoming a "convert" in the manner of Thomas Huxley. When the final smoke clouds of the Darwinian debates had been lifted, Gray emerged as the undisputed patriarch of American botanical science.

But undoubtedly Gray's main contribution was his daily work of classifying the material of the botanical explorations of the West which he and Engelmann were fostering. It was largely this tedious, time consuming work, which brought the center of gravity of American botany from Kew to Harvard and changed the flow of American material from its established lines to the Old World, to a young and vigorous center in the New World.

A. Hunter Dupree has presented a dynamic view of the unfolding of botanical history around Gray's life. Gray's first years when still an amateur collector, his friendship

---

[1] ASA GRAY by A. Hunter Dupree, 505 pp., 25 figures. 1959. The Belknap Press of Harvard University. $7.50.

with Torrey, his rise in scientific stature, and his eventual collaboration in the North American Flora are very well described. The hardships that Gray had to undergo in order to become a true full-time botanist in a nation which was itself undergoing the labors and pains of growth are fully expressed. The author also acknowledges the debt which Gray and American botany in general owe to Europe and the reader is made fully aware that independence and self rule came to American botany through evolution and growth, and that Gray always remained in touch with Kew and the continent, assimilating all that was new and relaying it to the American world.

An important facet in Gray's life which has not been forgotten by Dupree, is Gray's ability as a writer of Manuals and textbooks of botany. It will be interesting therefore for the reader to learn that these books, which played such an important role in botanical teaching during more than half a century, were often born to ease the poverty of its author, or, as in the case of the famous "Manual", to prevent a poor and unscientific tome from filling the gap of need. It speaks well of Gray's ability in all aspects of botany, that under such circumstances he managed to produce work of such high quality.

The book is well printed and presented, and the few illustrations are adequate. The style is pleasant, neither superficial nor too academic, and the book will make good reading for the botanist and the layman.

Undoubtedly in a book of this kind many things had to be left out. The author, I feel, has sacrificed the personal aspects in favor of the scientific ones, especially in the long discussion over Darwinism and the Darwinian debates. Nevertheless enough of Gray the man is there to appreciate Gray the botanist in his full worth. — OTTO T. SOLBRIG, GRAY HERBARIUM.

Volume 62, No. 734, including pages 31-60, was published February 24, 1960.